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**INSPEC - 1969 to date (INZZ)**

### Accession number & update

4982808, A9514-6170A-003; 950627.

### Title

Effect of rapid thermal annealing treatment on electrical properties and microstructure of **tantalum** oxide thin film deposited by plasma-enhanced chemical vapor deposition.

### Author(s)

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### Source

Journal-of-Applied-Physics (USA), vol.77, no.11, p.5978-81, 1 June 1995.

### CODEN

JAPIAU.

### ISSN

ISSN: 0021-8979, CCCC: 0021-8979/95/77(11)/5978/4/ (\$6.00).

### Publication year

1995.

### Language

EN.

### Publication type

J Journal Paper.

### Treatment codes

X Experimental.

### Abstract

Effect of high temperature annealing in the temperature range of 600-900 degrees C on the electrical properties and microstructure of **tantalum pentoxide** (Ta/sub 2/O/sub 5/) thin film deposited by plasma-enhanced chemical vapor deposition (PECVD) was studied. Leakage characteristics of the Ta/sub 2/O/sub 5/ thin film annealed at 600 degrees C were found to be the best in this study. However, it was observed that the leakage current in the polycrystalline Ta/sub 2/O/sub 5/ thin film decreased with increasing the annealing temperature above 800 degrees C after a peak for 700 degrees C annealing. The dielectric constant of the annealed Ta/sub 2/O/sub 5/ thin film was 26 after annealing at 600 degrees C, and decreased with the same tendency as the leakage current characteristics. Transmission electron microscopy (TEM) and X-ray diffraction (XRD) analysis indicated that the microstructure of the Ta/sub 2/O/sub 5/ thin film annealed above 800 degrees C was of delta -Ta/sub 2/O/sub 5/ with hexagonal **crystal structure**. Furthermore, TEM and AES observations

revealed that Ta-O-Si transition-layers were formed between the annealed Ta/sub 2/O/sub 5/ thin film and Si substrate. The electrical properties of the Ta/sub 2 /O/sub 5/ films are discussed in terms of interface modification and film densification due to rapid thermal annealing treatment. (16 refs) .

#### Descriptors

Auger-effect; crystal-microstructure; densification; electrical-conductivity; insulating-thin-films; leakage-currents; permittivity; plasma-CVD-coatings; rapid-thermal-annealing; tantalum-compounds; transmission-electron-microscopy; VLSI; X-ray-diffraction.

#### Keywords

rapid thermal annealing; electrical properties; microstructure; Ta2O5 thin film; plasma enhanced chemical vapor deposition; ULSI circuits; leakage current; dielectric constant; TEM; X ray diffraction; Auger electron spectra; interface modification; film densification; 600 to 900 C; Ta2O5.

#### Classification codes

A6170A (Annealing processes).  
A6855 (Thin film growth, **structure**, and epitaxy).  
A7360H (Electronic properties of insulating thin films).  
A6480G (Microstructure).  
A7720 (Dielectric permittivity).  
A7740 (Dielectric loss and relaxation).  
A7920F (Electron-surface impact: Auger emission).  
A8280P (Electron spectroscopy for chemical analysis (photoelectron, Auger spectroscopy, etc.)).

#### Chemical indexing

Ta2O5 bin, Ta2 bin, O5 bin, Ta bin, O bin.

#### Numerical indexing

temperature: 8.73E+02 to 1.17E+03 K.

#### Copyright statement

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